This paper investigates the precise mechanisms driving the cessation of transmission in classical epidemic models, speci
Introduction Understanding the mechanisms behind the cessation of infectious disease outbreaks is a core question of m
Methodology We employed both an ODE-based deterministic SIR model and a stochastic SIR simulation on an Erdős–
Analytical Model (ODE) We solved the standard SIR equations[0]: $\mathrm{dS}\frac{}{dt=-\beta\frac{SI}{N}\frac{dI}{dt}=\beta\frac{SI}{N}-\gamma I\frac{dR}{dt}=\gamma I}$ Simulation used scipy
Network-based SIR Simulation A stochastic, network-aware SIR simulation was constructed using FastGEMF over a ra
Results Figure (ODE/analytical) and Figure (network simulation) display the time courses of S, I, and R populations
[h] [width=0.6]figure-ODE.png Trajectories of susceptible (S), infected (I), and removed (R) compartments under the d
[h] [width=0.6]figure-network.png Trajectories of S, I, and R populations from network-aware SIR simulation.

[ht] Summary of Final Outcomes and Transmission Extinction Mode

Model	S_{final}	I_{final}	R_{final}	**Extinction m**
ODE (Analytic)	1075.2	0.09	8924.7	Infectives exti
Network	0.0	0.0	10 000.0	Both infective

Discussion Our results show a clear distinction in the mechanism of chain breakage. The classical (ODE) SIR model pr
Conversely, the network-based stochastic simulation resulted in near-total exhaustion of susceptibles, with all individua
These nuances are critical when interpreting epidemiological data and when using SIR-type models for forecasting or in
Conclusion The breakage of the transmission chain in SIR epidemics can occur due to the extinction of infectives or by
*References
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Compartmental models (epidemiology). Wikipedia. https://en.wikipedia.org/wiki/Compartmental$_m odels_($epidemiology$).A$c
P. Berenbrink et al., "On Early Extinction and the Effect of Travelling in the SIR Model", Proceedings of Machine Learning

Code and Reproducibility Full Python scripts for analytic (ODE) and GEMF-based network SIR simulation are availab

```
output/sir_analytical_ode_sim.py
output/sir_network_sim.py
output/analyze_extinction_sequence.py
output/plot_analysis_no_sns.py
```